DOCUMENT RESUME

ED 284 346 EA 019 553

AUTHOR Splaine, Pam; Frankel, Steven M.
TITLE Seat Belts in School Buses: A Technical Analysis of the Literature.
INSTITUTION Montgomery County Public Schools, Rockville, Md. Dept. of Educational Accountability.
PUB DATE Aug 86
NOTE 17p.; Exhibit contains small print.
PUB TYPE Information Analyses (070) -- Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Accident Prevention; *Accidents; Elementary Secondary Education; Injuries; *Restraints (Vehicle Safety); *Safety Equipment; *School Buses
IDENTIFIERS *Montgomery County Public Schools MD

ABSTRACT

This report, prepared for the Montgomery County (Maryland) Public Schools superintendent and board members, identifies the questions concerning seat belt use in school buses, examines relevant literature, and draws some conclusions. According to the literature, seat belts are one of many alternative and interdependent safety devices built into buses. Consequently, this report addresses three specific issues: (1) seat belts in new buses, (2) seat belts compared to other safety features, and (3) retrofitting existing buses with seat belts. Regarding the first issue, information falls into three categories: (1) active research (crash simulation studies), (2) investigations (examination of real accident statistics), and (3) discussions by local and state agencies. The studies and testimony provide inconclusive evidence regarding safety benefits and problems of equipping school buses with seat belts. Installing seat belts on new buses or buying seat-belt-equipped buses are the best options. Many newer features mandatory since 1977 (additional riveting, strengthened roofs, shatter-proof windows, and compartmentalization) have greater potential than seat belts for preventing accident injuries. Concerning the third issue, results show that prestandard buses should not be fitted with seat belts. This report recommends replacing all 230 of Montgomery County Schools' older buses immediately. One exhibit showing an analysis of costs over a 30-month period is included. (MLH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

D. Hymes

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ED284346

MONTGOMERY COUNTY
PUBLIC SCHOOLS
ROCKVILLE, MARYLAND

Seat Belts in School Buses: A Technical Analysis of the Literature

August 1986

Wilmer S. Cody
Superintendent of Schools

Prepared by the Department of Educational Accountability

EA 019 553

MONTGOMERY COUNTY PUBLIC SCHOOLS
Rockville, Maryland

SEAT BELTS IN SCHOOL BUSES:
A TECHNICAL ANALYSIS OF THE LITERATURE

by

Dr. Pam Splaine
Dr. Steven M. Frankel

Division of Administrative Analysis and Audits
Clifford M. Baacke, Director

Department of Educational Accountability
Dr. Steven M. Frankel, Director

TABLE OF CONTENTS

	Page
Introduction	1
Seat Belts in New Buses	1
Findings	1
Active Research	1
Investigations	3
Discussions	4
Conclusions	7
Seat Belts vs. Other Safety Features	7
Findings	7
Conclusion	10
Retrofitting Existing Buses with Seat Belts	10
Findings	10
Conclusions	12
Recommendations	12
Installing Seat Belts on New Buses	12
Retrofitting Seat Belts on Older Buses	13
A Better Alternative	13

SEAT BELTS IN SCHOOL BUSES
A TECHNICAL ANALYSIS OF THE LITERATURE

INTRODUCTION

The Department of Educational Accountability was asked to provide a technical analysis of the literature related to the use of seat belts in school buses for the purpose of providing the maximum amount of information upon which the superintendent and Board can base their decisions. This report identifies the questions, examines the literature, and comes to some conclusions.

In examining the literature, it became apparent that seat belts are only one safety feature which can be built into a school bus and that the efficacy of a seat belt as a safety device may be largely dependent on other safety features which have to be included--or omitted--from designs of particular models of buses. This literature finding led us to expand the original charge somewhat to include the question of the degree of relative safety achieved by using buses which have a wide range of safety features vs. those which were built before those features became commonplace.

Consequently, this literature search addressed three specific issues:

- Seat Belts in New Buses. Should seat belts be installed in all new school buses? The literature was searched to determine whether or not there was evidence that school bus passengers are safer with seat belts or without them.

- Seat Belts vs. Other Safety Features. Are there alternative "investments" in school bus features which have a greater potential than seat belts for preventing injuries when accidents occur?

- Retrofitting Existing Buses with Seat Belts. Should existing school buses be retrofitted with seat belts? What factors need to be considered in making this decision?

SEAT BELTS IN NEW BUSES

FINDINGS

A review of the literature shows numerous attempts to find a definitive answer to the question: Should seat belts be installed or not? The information falls into three major categories which can be called active research, investigations, and discussions.

Active Research

Active research refers to crash studies that simulate accidents using both belted and unbelted dummies to allow comparisons to be made about the relative safety of seat belts in an accident. To date, there have been only a few such studies.

Transport Canada, the Canadian government body comparable to our National Highway Traffic Safety Administration, released its study in 1985. It is the most widely cited crash test. Their results show that the potential for head injuries on school buses in frontal collisions increased when lap belts were employed.

This study used three belted and three unbelted dummies, simulating the size of a large elementary school student. It also used two dummies simulating the size of a small elementary school student. Both of these dummies were unbelted. The injury measure used is called the Head Injury Criterion (HIC). They reported that a "value of 1000 is the generally accepted threshold, above which serious injury or death is likely to occur.... The HIC for the belted dummies was approximately three times greater than the HIC for the unbelted dummies....(720 vs. 220). In addition, several belted dummies experienced severe rearward neck flexure, as a result of pivoting about the lap belt and striking the seat back in front with their head. This in itself was judged to cause at least serious injury."

An earlier study conducted in 1978 by the National Highway Transportation Safety Administration (NHTSA) used a similar paradigm and reached similar conclusions. The study found that belted dummies experienced a violent whipping effect that warranted further study. However, the NHTSA has not conducted any further crash tests and at present is not planning any.

The Transport Canada study was criticized by Kathleen Weber and John Melvin, researchers in the Department of Mechanical Engineering and Applied Mechanics of the University of Michigan, who see the results as incomplete and flawed in their interpretation. In a memorandum to "Colleagues concerned about Child Passenger Safety," they state that "no case can be made from the results of this test program that belted children will have an increased likelihood of severe head and neck injuries in frontal crashes" for the following reasons:

> "Although the belted dummies did measure higher HIC values than the unbelted dummies, the highest HIC value was only 731, which is well below the 1000 limit."
>
> "The reason for the higher HIC values among the restrained dummies supports the need for occupant restraints on buses. While the restrained dummy heads contacted the padded seatbacks, the unrestrained dummies hit the top of the seatbacks with their necks, where no load cells or accelerometers were mounted...."
>
> They also noted that a shorter belted dummy (emulating a younger child) would probably have missed the seatback entirely while still being safely retained in its seating position. But neither one of the small dummies was belted, so comparisons cannot be made.
>
> They report that no reliable prediction can be made regarding neck injuries because the dummies were not equipped to measure the resulting loads when the necks interacted with the tops of the seatbacks.
>
> In addition, Melvin and Weber claim that there is no biomechanical justification for judging neck extensions of several restrained dummies to be "life-threatening." "We know from field experience that humans

bend differently than these stiff dummies and do not tend to suffer 'life-threatening' neck injuries in these situations....the biomechanical research of H. J. Mertz and L. M. Patrick indicated that the human neck can withstand neck extension of at least 80 degrees without injury."

Both of these studies have been criticized for looking at only one type of crash--the frontal collisions. Because of this limitation, the results cannot be generalized to any other type of crash: side, rear collision, or rollover. However, according to Dan Consalvo of the National Safety Council, the frontal collision produces the most force both in cars and buses. Furthermore, Farr (Transport Canada), contends that the dummies available for use in the crashes are designed for frontal impacts, making it impossible to test for side impacts.

The Canadian government is currently conducting sled tests, which are simulated crash tests, for frontal collisions and 30 degree-off frontal collisions. They are experimenting with different seat designs for use with seat belts. Different types of restraints are also being studied, particularly lap belts vs. lap/shoulder belts. The results will hopefully determine whether more padding, for example, will decrease the HIC values on belted dummies that were found in their 1984 study. If it does, adding more padding would very likely be a minor modification to present seats. However, if the lap/shoulder belt is found to be better, an entirely new seat would probably be necessary, and this might require new federal legislation. These tests are scheduled for completion sometime in the fall of 1986.

Finally, Hunter (NHTSA) points out that there may not be a clear-cut solution. He notes that there is general agreement that in some situations, such as potential ejections, there is no question that seat-belted passengers will do better. However, he goes on to point out that ejections are rare; and he says that "some trade-offs may be necessary" in which the potential for nonlife-threatening harm in some accidents is balanced against other situations in which seat belts would prove beneficial.

Investigations

Investigations refer to research that examines statistics of actual accidents. The National Transportation Safety Board (NTSB) is a federal agency that performs most of these investigations, and their results, to date, have not permitted them to take a firm stand on the issue of seat belts on school buses. The NTSB's largest problem in this area has been that there have been too few accidents involving large poststandard school buses (buses built after April 1, 1977, when federal standards became effective) or school buses equipped with seat belts to permit them to draw solid conclusions. In addition, Suzanne Stack, a researcher with the NTSB, suggests that caution should be exercised when using this type of data source for the following additional reasons:

1. Not all accidents are reported.

2. Not all accidents are investigated. The NTSB tends to investigate only those accidents where fatalities occurred and which meet other criteria they have designated, and those that have come to

their attention.

3. Of the accidents that are reported, there is no consistent way across school districts, states, or the nation to report them. For example, some agencies report accidents with incapacitating injuries in lieu of all accidents; and even where all accidents are reported, some studies do not include field trips. Also, the National Safety Council (NSC) publishes statistics on school bus accidents but estimates injuries when states do not report them; and "school bus" as used by the NSC includes both pre- and post-standard large school buses (see later discussion), small school buses (which have seat belts--Type II), school vans, and any other vehicle used by the school.

Thus, for all of these reasons, the conclusion from the evidence from investigations does not contribute much in determining the relative safety of seat belts in school buses.

Discussions

The largest body of literature involves discussions on the seat-belt issue--largely local and state agencies trying to understand the question and find concrete evidence to make policy concerning the purchase of new school buses with or without seat belts. Most of this literature is a restatement of the crash studies noted above, conclusions drawn from selected investigations, and various experts' opinions on this subject.

The discussion literature can be divided into citations favoring the use of seat belts, citations opposing the use of seat belts, and those which merely present the discussion to readers listing the pros and cons on the issue. Some examples of each group follow:

Pro

The National Coalition for Seat Belts in School Buses (NCSSB) is perhaps the most vocal group in favor of seat belts. In a letter to the director of MCPS Transportation Department, a representative of the NCSSB asserts that they "promote the installation of seat belts on school buses for three reasons: (1) injury reduction, (2) educational habit carry-over from school bus to family car to protect children from the Number 1 killer--the automobile accident, and (3) improved discipline for reduced driver error." Note that two of the three reasons are nontechnical or user related.

The Eugene (Oregon) School District in a report released in March 1986 recommended that "all new school buses purchased be equipped with 28 inch high seats having seat belts attached." They further recommend that "...all passengers, including adults, wear these belts...."

The Fairfax County Public Schools in Virginia has just recently recommended buying factory-installed seat belts in all new buses. However, they decided that the use of the seat belts should be voluntary. "The optional use was recommended by School Board Counsel because mandatory use, prior to more specific test results, could result in litigation if a student sustained a severe head injury which

could be shown to have been exacerbated by lap restraints."

Con

Eight of the ten citations represented in the literature that was surveyed for this report showed a decision not to require the installation of seat belts. Most of the decisions were made at the State Department of Education level. Most of these institutions conducted a thorough review of the literature, and Alaska even hosted a conference on the topic. A frequent conclusion is that the use of belts should not be mandated until more concrete evidence is available to prove that seat belts are better than compartmentalization alone.

In the face of much local pressure, many state and local agencies have put off making a decision until more and better research has been done, i.e., crash tests and reliable comparisons of seat belt and non-seat belt use in accidents involving fatalities. Since there are very few accidents involving school buses that result in fatalities and since the voluntary use of seat belts is a recent occurrence, very little data will be available for this purpose in the next few years. Either despite or because of this, some state and local agencies have made policies that state in effect that they will not install seat belts until further research proves that it is advisable to use them. Others have voluntarily purchased their new buses equipped with seat belts.

Four of the five national organizations who came out against the use of seat belts in school buses did so because they believed that compartmentalization without belts is safe. The National Safety Council agrees with this passive restraint system until further study is done. The National School Boards Association opposes federal legislation that would mandate the installation of seat belts in school buses but pushes for a national study by the National Highway Traffic Safety Administration (NHTSA). Physicians for Automotive Safety (PAS) have also requested the NHTSA to conduct a national study.

Barry Sweedler, director of the Bureau of Safety Programs of the National Transportation Safety Board (NTSB), spoke to the Fairfax County School Board on May 22, 1986. In providing the "Federal Position," Sweedler "...stated that the NTSB position is that the 'passive crash protection approach' using the post-1977 Department of Transportation (DOT) compartmentalization design is the best approach. However, he added that NTSB would not discourage the use of lap belts where desired by parents and/or school divisions."

The National Highway Traffic Safety Administration believes that "...children should be protected on school buses but does not support a requirement for seat belts for passengers in large school buses. Improving the seating compartment eliminates the need for seat belts and provides sufficient crash protection."

The Tenth National Conference on School Transportation held in May of 1985 represented the National Association of State Directors of Pupil Transportation, the National Association of Pupil Transportation, the National School Transportation Association, the National Safety

Council, the School Bus Manufacturers Institute, and the Central Missouri State University. A series of recommendations were made, two of which were:

> ...That local, state, and federal governments and the general public recognize the passive restraint system in school buses manufactured after April 1, 1977, has been proven to be a more effective passenger protection system in school buses than the protection provided by seat belts; and
>
> That local, state, and federal governments discourage the mandatory installation and use of seat belts in school buses until such time that extensive and scientific research proves them to be more effective in injury prevention than the existing passive restraint systems.

Ted Turner, an engineer with the Blue Bird Bus Company, contends that several structural changes should be made to buses to install seat belts properly. These changes involve the seat frames, seat anchorages and the bus floor. He says that these changes are at variance with current standards and would require changes in the law. However, some bus companies disagree with this argument. They include seat belts as only one component of an upgraded seating package which includes other features such as stronger seat anchoring systems, more seat reinforcement, etc.

Neither Pro Nor Con

Other groups that have not taken a position either pro or con have also called for more and better research that will give conclusive evidence of the safety or harm of seat belts on school buses. The Physicians for Automotive Safety (PAS) is one such group. The Blue Bird Bus Company, a major manufacturer of school buses, is another.

The call for more research appears throughout the literature. The National Transportation Safety Board is currently conducting a study of accidents involving poststandard large school buses. Their results are planned to be released in the fall of 1986. This should provide some needed data on accidents involving poststandard buses, but it does not take the place of data provided by crash testing. Because of the paucity of accidents involving buses with seat belts, the results will probably be inconclusive. The California Highway Patrol and their Department of Education have proposed a study which would include one or more crash tests (depending on cost). They are waiting for the California legislature to approve funding.

By its very nature, the discussion literature frequently introduces relevant nonsafety issues. However, the evidence on which the discussion rests is usually restricted to the same few studies and limited investigations which were summarized in the preceding two sections.

In addition, it should be noted that this past year, when MCPS buses were ordered with installed seat belts, the "seat belt package" provided by the manufacturers included a stronger seat, extra bolts to anchor the seats more firmly, and lower seat backs reinforced with extra bars to support the

use of a seat belt. The cost of buying installed seat belts, then, includes a seat that is reinforced. Furthermore, if such a package is bought, the seat belts can be purchased at the same time or at a later date.

The incremental cost of a bus with the same belt package compared to the cost of a bus with standard seats was approximately $1,600 per large 54-passenger bus this year. Roughly half of that amount bought the reinforced seat and the remaining half paid for the belts. Thus, buying a new bus equipped with seat belts provides more in the way of safety features than most people assume.

An additional issue regarding the seats is the height of the seat back. MCPS bus seats are 24" high, the same as most buses nationwide. However, some school districts, like Eugene, Oregon, and some in New York, believe that a 28" seat back provides more protection for a passenger whose head exceeds the 24" back. In addition, they believe the higher seat backs minimize the chance of the belted passenger's face striking the top of the seat in the case of a crash in which the passenger "jackknifes forward. There is not enough evidence from the literature to know whether the 28" backs are better, but it is an issue that should be watched carefully in the future.

CONCLUSIONS

The studies and testimony examined in this project provide inconclusive evidence regarding the safety benefits and problems of equipping school buses with seat belts. In some situations, such as frontal collisions, there is some data to suggest that belted passengers may suffer some non-life-threatening injuries due to the belts. In other situations, such as rollovers, experts generally agree that belted passengers may have an advantage. Therefore, as Guy Hunter of the National Highway Traffic Safety Administration notes, "some trade-offs may be necessary."

To best preserve our options, the most prudent alternatives seem to be either to equip all new buses with seat belts (which can be removed if more negative evidence comes to light) or to buy buses which are "seat-belt ready" so that the belts can be added at a later date.

SEAT BELTS VS. OTHER SAFETY FEATURES

FINDINGS

Much work was done over the past decade to lead to a set of national minimal standards for school buses. These standards became effective on April 1, 1977.

In a series of tests done by the Institute of Transportation and Traffic Engineering at UCLA in the late 1960s, it was found that the inadequacy of the seat in a school bus was the major cause of injury. The National Transportation Safety Board (NTSB) also conducted a series of investigations of serious accidents involving school buses. In 1970, the NTSB published a report that focused on the safety flaws in school buses and urged manufacturers to voluntarily strengthen the connecting joints in their buses. In 1974, Public Law 93-492 included school bus safety amendments.

These amendments resulted in the Federal Motor Vehicle Safety Standards (FMVSS) relating to school buses.

All yellow school bus bodies mounted on chassis built after April 1, 1977, by law have had to include the following specific features which were not widely used prior to this date in prestandard buses:

> Additional riveting and fasteners are placed much closer together in order to strengthen the sheet metal panels comprising the bus shell. This helps prevent exposed edges in crashes. (FMVSS 221)
>
> Roofs are strengthened to where they would not sink more than five and one-eighth inches when a force equal to one and a half times the total bus weight is applied to the top. This decreases the possibility of collapse during rollovers. "In prestandard buses, the body often fails to withstand crashes. If this happens, the roof can be crushed." (FMVSS 220)
>
> Protective metal baskets are wrapped around previously unguarded fuel tanks to prevent potential fires. (FMVSS 301)
>
> Windows have to be resistant to shattering in crashes and emergency exits, including rear doors, are installed to allow accessible escape routes for trapped passengers. (FMVSS 217)
>
> Probably most important, the "compartmentalization" concept is adopted for seating. High-backed, densely padded seats are placed closer together to better protect heads and extremities. Also, a seat and its parts are strengthened to no longer permit separation of the seat from the floor. This phenomenon has occurred in older buses during crashes. (FMVSS 222)

In contrast to the prestandard buses, it is now generally agreed that poststandard school buses are the safest mode of transportation in the country. Fatalities are low. An average of 10 students die each year in school bus crashes nationwide. Further, 90 percent of the injuries sustained in school bus crashes are classified in the minor to moderate range. The American Transportation Company reported that "in 1982, the last year for which data is available, the rate of fatalities in school bus accidents per hundred million vehicle miles was 0.29 (eight deaths). This compares to 29.69 for motorcycles, 2.06 for passenger cars, 1.21 for combination trucks, and 8.75 for commercial airlines."

However, MCPS is still using many prestandard buses.

The current MCPS school bus fleet is reflected in Table 1. Last year, FY 1986, MCPS ordered 51 new school buses with factory-installed seat belts.

More new school buses with seat belts were ordered for FY 87. However, note that 29 percent of the school bus fleet (230 buses) is made up of prestandard buses; i.e., buses that do not meet the minimum requirements for poststandard buses.

MCPS usually replaces its buses every 12 years, the maximum period state law permits them to be retained. This means that in FY 88, 59 prestandard buses will need to be replaced; in FY 89, another 73 prestandard buses must be replaced; and in FY 90, the remaining 98 prestandard buses must go. Under present plans, it is assumed that some MCPS students will be traveling on prestandard buses for up to four more years.

TABLE 1
School Bus Fleet
Montgomery County Public Schools
1986-87

Size	Poststandard		Prestandard	Total
	Without seat belts	With seat belts		
18-passenger			43	43
26-passenger	114			114
29-passenger	32	52		84
54-passenger	279	88	187	554
Total	425	140	230	795

In addition to the safety issues, prestandard buses cost more money to operate than the poststandard buses. They need many repairs because they are old and because they were not built as well. In particular, the 73 1976 Dodge buses, which do not come up for replacement for two more years, have needed more repairs than usual and have special safety problems which only expensive repairs can remedy. It is estimated that approximately a third of the 1976 buses will each need $2000 to $3000 worth of additional repairs to keep them in service for the next two years. In addition, Dodge is no longer in the business of making school buses; and the parts needed to repair the buses are either not available or hard to find. For example, MCPS must buy fenders in Canada when they are available and cowlings in Mexico. This increases "down time" and maintenance costs further.

Another cost to be taken into account is fuel. We are now purchasing diesel-powered buses which average approximately twice the miles per gallon of a gasoline-powered bus. Currently, the price per gallon of gasoline and diesel fuel is comparable. Thus, the fuel costs of the gasoline-powered prestandard buses are about twice those of the more modern buses in our fleet.

The sum total of the safety data relating to pre- vs. poststandard buses, and financial data, suggests that MCPS may have a better alternative than its present plans for gradually replacing the 230 prestandard buses over the next three years. The alternative, of course, is to replace all 230 buses

immediately, using an installment purchase to permit the buses to be delivered as quickly as possible (January 1987 is the target date) while deferring payments until FY 1988, 1989, and 1990.

Exhibit 1 presents a cost analysis in which our present plans for replacing buses over three years is compared with the costs of replacing the 230 buses immediately. We found that:

> Under our present plans, the total cost of operating and replacing the 230 buses over the next three years is $10,465,815.
>
> The new suggested plan shows that if MCPS purchased all 230 prestandard buses immediately using a 30-month installment purchase with three equal payments being made in July 1987, July 1988, and July 1989, the cost is only $9,810,676.

Thus, this new plan not only permits all the less-safe prestandard buses to be removed from the fleet within six months, but it also generates savings of $655,139.

CONCLUSION

In contrast to the ambiguity regarding the issue of installing seat belts on buses, it is clear that prestandard buses are inherently more dangerous to students in accidents as well as being more expensive to operate.

Thus, the answer to the question, "Are there alternative 'investments' in school bus features which have a greater potential than seat belts for preventing injuries after accidents occur?" is a resounding "yes."

RETROFITTING EXISTING BUSES WITH SEAT BELTS

FINDINGS

The discussion of retrofitting existing buses with seat belts must be divided into two questions. Should prestandard buses be retrofitted, and should poststandard buses be retrofitted with seat belts?

The National Highway Traffic Safety Board (NHTSA) reported that "under no circumstances should belts be added to buses that were manufactured before 1977. The old bus seats have an exposed rail. Because of the dynamics of a crash, lap belts would actually increase the force with which an occupant's head would strike the rail." According to the major manufacturers of large school buses, several problems prevent successful retrofitting of prestandard buses. "Seats may not be well anchored to the floor and, in many cases, have no padding to cover the metal seat frame. Also, the seat construction may be inadequate to withstand the forces generated by lap belts and could collapse with pupils belted to them." While MCPS prestandard buses do not have the exposed metal rail, the other arguments presented seem to indicate that retrofitting prestandard buses is counterproductive.

EXHIBIT 1

ANALYSIS OF COSTS FOR 30-MONTH PERIOD 1/1/87-7/1/89 UNDER 2 DIFFERENT BUS REPLACEMENT PLANS

	PURCHASE COSTS	FUEL COSTS	MAINTENANCE COSTS	SALES OF OLD BUSES	NET COST
SUGGESTED PLAN Replace all 230 pre-standard buses 1/1/87 using 30-month install-ment purchase with pay-ments made 7/1/87, 7/1/88 and 7/1/89.	$33,703 * 230 = $7,751,690 without in-terest; and $8,681,893 with interest @ 8%	14,000 miles / 8 mpg * $.75 gal * 230 buses * 2.5 yrs = $754,688	costs are $690, $1642 & $1,949 for years 1, 2 & 3 in our fleet; thus for 30 months [($690 + $1642 + (.5*1949)] * 230 = $760,495	$1680 * $230 = ($386,400)	
TOTAL SPENT - SUGGESTED PLAN	$8,681,893	$754,688	$760,495	($386,400)	$9,810,676
PRESENT PLAN					
Period A: 1/1/87-6/30/87 Use 230 prestandard buses.	NONE	14,000 miles / 4 mpg * $.75 gal * 230 buses * .5 yrs = $301,875	costs are $3238, $3331, & $3907 for years 10, 11 & 12. Thus [(77*$3238) + (77*$3331) + (76*$3907)]/2 = $401,373	NONE	$703,248
Period B: 7/1/87-6/30/88 After buying 77 poststandard buses, use 153 prestandard and 77 poststandard buses.	$33,703 * 77 = $2,595,131	(14,000 miles / 4 mpg * $.75 gal * 153 buses) + (14,000 miles /8 mpg * $.75 gal * 77 buses) = $502,688	(77*$690)+(77 * $3331)+(76 * $3907) = $606,549	$1240 * 77 = ($95,480)	$3,608,888
Period C: 7/1/88-7/1/89 After buying another 77 poststandard buses, use 76 prestandard and 154 post-standard buses.	$33,703 * 1.04 * 77 = $2,698,936 (assumes 4% price increase for 2nd year)	(14,000 miles / 4 mpg * $.75 gal * 76 buses) + (14,000 miles /8 mpg * $.75 gal * 154 buses) = $601,625	(77*$690)+(77 * $1642)+(76 * $3907) = $476,496	$1240 * 153 = ($189,720)	$6,153,679
NOTE: Replacement of remaining 76 prestandard buses on 7/1/89 will mean that fleet will consist only of poststandard buses.	$33,703 * 1.08 * 76 = $2,766,342 (assumes another 4% increase for 3rd year)				
TOTAL SPENT - PRESENT PLAN	$8,060,409	$1,206,188	$1,484,418	($285,200)	$10,465,815
SUMMARY - SUGGESTED PLAN: COSTS $621,484		SAVES $451,500	SAVES $723,923	SAVES $101,200	SAVES 655,139

NOTES:

A. PURCHASE PRICES ASSUME SEATBELTS INSTALLED. MAKING BUSES ONLY "SEATBELT READY" WOULD SAVE ABOUT $103,500; AND BUYING BUSES WHICH AREN'T SEATBELT READY WOULD SAVE ROUGHLY $207,000.

B. THE ABOVE ANALYSIS ESTIMATES DIRECT BUDGETARY COSTS ONLY. FROM AN ACCOUNTING PERSPECTIVE, THE $655,139 BUDGETARY SAVING UNDER THE SUGGESTED PLAN SHOULD BE OFFSET BY $613,502 IN INCREASED DEPRECIATION. THIS IS BECAUSE, IF DEPRE-CIATION IS CALCULATED ON A 12-YEAR STRAIGHT-LINE BASIS, IT IS ESTIMATED AT $1,614,935 UNDER THE SUGGESTED PLAN VS. $1,001,433 UNDER THE PRESENT PLAN.

C. THE ANALYSIS OF THE PRESENT PLAN ASSUMES FOR SIMPLICITY'S SAKE THAT 230 PRESTANDARD BUSES WOULD BE REPLACED AT RATES OF 77, 77 AND 76 OVER THE NEXT 3 FISCAL YEARS. THE ACTUAL PLANNED DISTRIBUTION OF PURCHASE OF 230 BUSES MAY VARY FROM THAT.

On the other hand, NHTSA has said that it is safe to attach the lap belts to the current seats in poststandard buses. However, they say that school systems should be sure to purchase lap belts that meet Federal Standard 209 and check to see how they are installed. But bus manufacturing companies do not believe it is advisable to retrofit even the poststandard buses, and the National Coalition for Seat Belts on School Buses supports this industry position.

CONCLUSIONS

Prestandard buses should not be retrofitted with seat belts; and the issue of retrofitting poststandard buses should be approached with caution, given the differences of opinions that exist between the National Highway Traffic Safety Administration and at least some bus manufacturers.

RECOMMENDATIONS

The major question which this activity has addressed is whether installing seat belts in school buses is a worthwhile investment in terms of increased safety for students.

INSTALLING SEAT BELTS ON NEW BUSES

It has been learned that there is no strong research-based answer to the question of whether school systems should buy their new buses equipped with seat belts.

However, the basic reason for this ambiguity is the fact that there are so few serious injuries which occur on school buses. Couple this with the fact that only a tiny fraction of school buses are seat-belt equipped, and it is clear that it will probably be a decade or more before experience-based answers are found to this question. The literature search revealed no other crash test studies which are underway or planned and which might shed more light on this issue.

Thus, the lack of evidence regarding the efficacy of installing seat belts does not necessarily suggest that they are not useful. In addition, given the additional seat-strengthening features which many bus manufacturers include as part of a seat belt package, purchasing either buses with belts or buses which can later be equipped with belts, can be considered to be eminently reasonable.

This will certainly prove to be the case if seat belts are later found to be effective. For, given the findings related to retrofitting, it seems to be clear that adding belts later is not as safe and is more expensive than buying buses which are at least seat belt ready in the first place. Thus a decision to order future buses which are either equipped with belts or are "belt ready" may be based more on cost avoidance considerations than on the safety data that are presently available.

The prevailing trend seems to be that, given the present uncertainty, seat-belt use by students on school buses should be optional. Some school systems and states contend that this will cover the school system in protecting itself against liability suits in the event that the belts are

later shown to be harmful. On the other hand, some will be concerned that this is sending a mixed message to children on the use of seat belts which could adversely affect their behavior in the family car.

RETROFITTING SEAT BELTS ON OLDER BUSES

Findings are very clear that there is no advantage in fitting seat belts on prestandard buses. The best thing that can happen to these buses is an early demise, and there is some evidence that retrofitting them with seat belts may actually make them more dangerous.

The picture is less clear when it comes to poststandard buses. Here some groups suggest that if the seats are adequately anchored to the floor and if seat belts can be securely anchored as well, retrofitting is at least feasible. However, others reject this approach; and, in any case, it will be more expensive than buying the buses with belts in the first place. Also, unless the buses are ordered with the additional features which are included in many seat belt packages, the result will still be a bus with fewer safety features than a bus which left the factory with the standard seat-belt package.

In sum, if the data in favor of installing seat belts on new buses is neutral, the data on retrofitting poststandard buses is somewhat negative.

A BETTER ALTERNATIVE

The most startling conclusion to come out of this literature search is that MCPS may have been focusing on the wrong issue. For, while the evidence is mixed and ambiguous when it comes to seat belts, it is absolutely clear when it comes to prestandard vs. poststandard buses; that is, although school buses are the safest mode of transportation in the United States, the chances of being injured seriously on a prestandard bus are significantly greater than on a poststandard bus.

Considering also the fact that the prestandard buses in the MCPS fleet are much more expensive to maintain and operate, it is clear that the best safety investment MCPS can make is to get all prestandard buses off the road as quickly as possible.

As shown by our cost analysis, under the present plans the cost of operating and replacing the 230 buses over the next three years is estimated to be $10,465,815. But, if all the buses are replaced immediately under our suggested plan, the cost is only $9,810,676; for a total savings of $655,139.

Therefore, by replacing all 230 prestandard buses immediately, MCPS will not only provide safer transportation for children but will improve its financial picture as well.

539b.doc